TOPICAL PVP + NEOSPORIN IN THE TREATMENT OF THERMAL INJURIES "A NEW APPROACH"

THESIS
FOR
MASTER OF SURGERY
(GENERAL SURGERY)

BUNDELKHAND UNIVERSITY
JHANSI

1991

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This is to certify that the work entitled, "TOPICAL PVP + NEOSPORIN IN THE TREATMENT OF THERMAL INJURIES - A NEW APPROACH" has been carried out by Dr. SUNIL KUMAR TYAGI himself in this department.

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C E R T I F I C A T E

Certified that the work entitled "TOPICAL PVP + NEOSPORIN IN THE TREATMENT OF THERMAL INJURIES - A NEW APPROACH" has been carried out by Dr. SUNIL KUMAR TYAGI, under my constant supervision and guidance. The results and observations were checked and verified by me from time to time.

This thesis fulfils the basic ordinances governing the submission of Thesis for M.S., laid down by Bundelkhand University.

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C E R T I F I C A T E

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ACKNOWLEDGEMENTS

Words are sometimes hard to find when you are trying to say thanks for something so priceless as loving criticism, considerate helpfulness and valuable guidance. Gratitude and sincerity resemble a spice which if too repels you and too little leaves you wanting. Yet, facts must be evidently acknowledged and honest thankfulness unequivocally stated. This is what I have humbly attempted to do here.

There can be no greater opportunity than this to express my profound sense of gratitude to my esteemed and exalted Guide & teacher, Dr. Rajeev Sinha, M.S., Lecturer, Department of Surgery, M.L.B. Medical College, Jhansi, who with his unfathomed knowledge and untiring zest for work guided me unflinchingly throughout this humble venture. His uncompromising standard, exemplary dedication and unequivocal precision set the trend and pace for this work. His firm initiatives, timely and constructive criticism, divine inspirations and above all a benevolent attitude went a long way towards completion of this work.

I feel highly obliged to Dr. R.k. Agarwal, M.D., Associate Professor & Head of the Department of Microbiology, M.L.B. Medical College, Jhansi, under whose supervision, work actually started taking its shape and which has

provided me the great confidence and enthusiasm so essentially vital for successful accomplishment of such a project.

I acknowledge with sincere thanks the affectionate nature, heartening words and constant encouragement of Dr. S.L. Agarwal, M.S.,F.R.C.S., Professor & Head of the Department of Surgery, M.L.B. Medical College, Jhansi.

I am highly obliged to Dr. R.P. Kala, M.S., and Dr. D. Pratap, M.S., for their great support and helpful suggestions from time to time.

I dedicate my work to love, perseverance and understanding shared by Miss Archana Sharma, who was the source of my inspiration and solace to me for execution of this cumbersom task.

I am specially thankful to Mr. K.M. Thomas for bringing out the work in representable form by his excellent ability of preparing type-script.

Lastly, I am highly obliged to those unfortunate burned patients, who became the subject of this work.

Dated : 17/2/81,

(SUNIL KUMAR TYAGI)

C O N T E N T S

INTRODUCTION

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Since man first learned to make fires, burns have caused great suffering to mankind physically, socially as well as economically. With the advancement of science and increasing mechanisation, there has been a greater incidence of burns. One person is burnt every minute in the world and its sequelae is often the cause of personal and family tragedy.

Thermal burns are caused by application of heat to the body. The depth of the resulting burn injury is dependent on the intensity and duration of this heat application and the conductivity of tissue involved. The most common heat sources are an open flame and hot liquid. In addition, thermal injury is frequently observed in patients who have been exposed to direct contact with hot metal, toxic chemicals or high voltage electric current.

Laboratory accidents, civilians assaults, industrial mishaps and inexpert application of agent used for medical purposes account for most of chemical burns in the civil population. A principle difference between thermal and chemical injury is the length of time during which tissue destruction continues. The chemical agents

cause progressive damage until inactivated by reaction with tissue, while thermal injury ceases shortly after removal of the heat source.

Burns produce wide raw areas. Coverage of these areas expeditiously still remains an integral but unsurmontable part of the treatment. The coverage is,

(i) To protect micro-organism invasion from outside.

(ii) To prevent abnormal loss of heat and body constituents i.e. water, minerals and protein from within.

(iii) To minimize pain which is caused by the irritation of exposed nerve endings by the clothing, dressing or even the mere contact of air. This can not be completely controlled by medication but can be reduced to a great extent by avoiding daily dressings after application of some biological, synthetic covering or Povidone spray combined with Neosporin powder.

Since early 19th century, idea of autogenous skin grafting to cover the raw surface came into existence and is still being used, but it has the following limitations :

1. If burn area is very large, required amount of autograft donor area may not be available.

2. Patients who are already in shock usually are not fit for surgery.

3. Patients and/or his relatives may refuse surgery due to religious, sentimental or ethical causes.

Various other biological or synthetic materials have been used by various workers at different times. Different biological coverings are homografts, skin heterograft, skin collagen sheets, and foetal membrane (Amnion and/or chorion). Synthetic materials include solid silicons, polymer membrane, cotton gauze, fabrics, sprays, gels and laminates etc.

Infection is a great problem in neglected cases of burn which is already the seat of resistant strains of bacteria. This can be controlled by the use of antibiotics after culture and sensitivity of the pus and also by local cleaning of the raw infected area. Once the infection is controlled further infection can be prevented by some barrier covering. This saves unnecessary expenses on costly medicines for long duration and prevents the hazards of antibiotics. This infection also interferes with and delays the normal healing process resulting in contractures and deformities.

Infection has already been considered an important aspect of burn morbidity and mortality. Liedberg and

Moncreif have all stressed that extensive bacterial colonisation of burn wound with subsequent dissemination via blood stream leads to septicaemia. Thus topical treatment of burn wounds takes on an added importance. Inspite of the advent of newer antibiotics, infection of the burn wound still remains the most challenging problem due to the avascular nature of burn tissue as a result of thrombosis of vessels which limits the delivery of endogenous phagocytic cells and also decreases the efficacy of systemically administered antibiotics. In addition to the infection, wound maceration and pressure necrosis also favoures microbial proliferation and impairs circulation. A large area with its exudate of serum is like a huge culture plate on which organism can multiply uninhibitedly. The inability of systemic therapy to control local sepsis has seen the introduction of many local form of treatment modalities directed at this problem.

Topical therapy has contributed substantially to the reduction of sepsis in the fight against infection. The importance of topical therapy was recognised as early as the last century when simple wound cleaning and cotton wool dressings were used even before the Lister era.

Povidone Iodine and Neosporin powder are being used in superficial and deep burns with the idea of

avoiding pain due to no need of daily changing of dressings by which we can avoid the irritation of exposed nerve endings as in closed dressings. At the same time comparative study is made to assess the superiority of other local application.

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REVIEW OF LITERATURE

REVIEW OF LITERATURE

Even with the ongoing advances in medical sciences problem of burn management still remains a threat to life. These injuries either due to fire, radiation, electricity or chemical agents have achieved greater importance socially, medically and economically with successive years due to the greater hazards associated with the changing life styles of mankind.

In Ancient Era :

As far back as 1500 B.C. Papyrus had used cow-dung to topically to treat burn injuries. Ancient Indian literature shows that Sushruta used a mixture of butter with red achro or the bark of a fig tree. He also debrided severe burns with loose skin and flesh. Around the 5th or 6th centuries, B.C., the Egyptians were treating burns by incineration and a mixture of gum, goat's hair and milk from a lady who had given birth to a son. Chinese & Japanese were using tinctures and extracts made from tea leaves around 430 B.C.

In ancient Rome, three methods were used - (i) Celsus suggested mixture of honey and bran, (ii) Pliny and Elder suggested exposure method, and (iii) Galen

suggested local application of Vinegar or wine over burn surfaces.

In 7th Century A.D., Paulus of Aegina used various emolient preparations. Rhazes (A.D. 980-923) had been using white lead, oil of roses and wax. He also used ice-cold water locally. Apart from excision of contracted scars described by Celsus, surgery had no place in the treatment of burns for Greeks & Romans. Velesco de Tarenta of Montpellier (1490) described a method to avoid syndactyly in the burnt extrimities.

Ambrose Pase (1517-1590) suggested ointments for the treatment of burn wounds. Claws (1591) used 5 different complex preparations on the different parts of the body area involved in burn. David Cleghron (1792) used the vinegar and chalk poultices locally. Edward Kentish (1979) suggested pressure dressings to relieve pain and to stop blisters formation. Sir James Earle (1799) suggested the use of ice-cold water and indicated that it acts as a good analgesic and prevents oedema formation. Syme (1827) suggested the use of dry cotton wool dressing with firm pressure.

Gailhetmus Febricus Hildanus (1607), the 'father of German Surgery' described 3 degrees of burn according to depth. L. Heister (1683-1758) classified the burns into four degrees according to depth and including time factor.

Boyer (1814) classified burns into three degrees - (i) Erythmea, (ii) Blisters leading to superficial ulcers and (iii) Eschar.

Dupaytsen (1932) classified the burn into 5 degrees according to depth of involved tissue.

1. Erythema or superficial ecehymosis which blanches on pressure.
2. Cutaneous inflammation with the loss of epidermis and the development of vesicles filled with serum.
3. The destruction of a portion of the papillary body.
4. The disorganization of whole dermis to a subcutaneous cellular tissue.
5. The formation of eschars of all the carbonization of the whole thickness of burnt part.

He also described the 4 periods during the natural course of burn injury.

1. Period of irritation,
2. Period of inflammation,
3. Period of suppuration,
4. Period of exhaustion.

Alongwith, he also described the gastro-intestinal haemorrhage in the burn case. Later, Curling (1842)

recognized gastric and duodenal ulcers as a cause of gastro-intestinal haemorrhage in burn cases.

Between 1833 & 1868, the dry method of dressing was the principal one. Syme in his 'Principles of Surgery' (1834) stated that this form of therapy had almost superseded the filthy and useless application of carron oil and linimentom aquae calcis. The dry method had been introduced in the British Isles from America prior to 1833.

Copeland (1871) suggested the exposure method in the treatment of burns. Then came the year 1868 and Lister's followers immediately applied his antiseptic practices to the burn wound. Between 1868 & 1885, 2.5% carbolic acid in oil was used to soak the lint applied to injury and the dressing was removed every other day. Carbolic acid in this concentration causes local gangrene thus converting primary partial thickness burn into full thickness. Carbolic acid absorbed through the burnt area leads to symptoms and signs of phenol poisoning i.e. Muscle twitching, excitement, weakness, nausea, vomiting, delirium, prespiration and hypotension.

Period between 1885 and 1910 could be called as saline wet dressing antiseptic era. Wet dressing with sodium bicarbonate were first applied with solution of picric acid or boric acid put on. A. Maclennan (1903) and E.J. Elliot (1906) described Picric acid poisoning following

its use on dressing applied to burns. Picric acid induces tachycardia, nausea, vomiting, diarrhoea, moderate fever, dysoris, renal insufficiency, discoloured urine, stupor, coma and collapse.

The systemic absorption of boric acid is known to be followed by rashes with desquamation of skin, restlessness, confusion and weakness, hypothermis, hypotension, tachycardia, loss of hair and renal injuries.

From 1910 to 1926 wax was highly recommended for the dressing of burn. Wax contained 250 mg% B-napthol and it was applied at temperature of 50° - 60°C. Beta Naphthal causes extensive renal hepatic damage with convulsive seizures and even death.

Daxitson (1894-1933) advocated the uses of Tannic acid application on burn surfaces. The idea was discarded as mortality doubled than that of control series due to fatal hepatic degeneration and the conversion of initial partial thickness burn to a full thickness burn.

Aldridge (1933) advised the use of gention violet as an escharotic agent on burn surface.

Recent Era :

In 1942, Allen and Koch used petroleum gauze piece locally with strict immobilisation in World War-II.

Wallace of Edinburgh (1949) in England & Pulaki Artzi and Blooker (1950) in U.S.A. re-introduced exposure method for wound - i.e. the principle of this method is that drying the area of burn inhibits the growth of bacteria and ultra-violet sunlight is hostile to bacterial growth, eventually a dry surface is obtained and topical agents may be applied as a further deterrent to bacterial growth.

Later on, other surgeons accepted the same method with the view that development of crust provided physiological covering of burn wound, thus reducing the effect of raw area.

Ludbug Reiss and Artz (1953) attributed primary cause of death to septicaemic and staphylococci to be the main microbial.

As antibiotics against Gram positive organism developed, the sepsis due to Pseudomonas became very common and cause of death was attributed to it. It was because of gram negative organism and other microbials that a great importance was laid to develop the antimicrobial agent which can penetrate the burn surface and minimize the growth of such microbials. Various such antimicrobials, e.g. 0.5% silver nitrate (Mayer), Mefemide or sulfamylon (Mon-crief), Cerium nitrate (Williams W. Monafo), Silver sulfadiazine (Fox, O.L., 1975, Rappapole, B.W., Stanford, W.

1969) were tried and still in use. But these topical agents are effective merely in controlling microbial population. It is stated that from an average of 10^7 micro-organism per gram of tissue it reduced to 10^4 per gram of tissue by these agents.

0.5% Silver nitrate dressing benefit the burn patient, they are dangerous. The biologic dangers of silver nitrate wet dressing are metal toxicity, depletion of body salts and necrobiosis. The dangers of sodium chloride depletion with use of the silver nitrate dressings are so immediate that the dressing should not be used without very frequent monitoring of serum sodium chloride and bicarbonates.

Silver sulphadiazine has been introduced to replace silver nitrate in topical treatment of burns. It has the following advantages - 1. It readily penetrates eschar, 2. Eschar does not adhere to the dressing, 3. Silver Ions are released slowly from the preparation in concentration that are selectively toxic to pathogens. Silver ions combines with the sulfahydryl carboxyl. phosphate and other biologically active groups. Such interaction involving a protein alter its physiological properties and often cause it to precipitate. Silver ion acts on bacterial cell surface to cause drastic alteration in cell wall and plasma membrane leading to death of the bacteria. This drug inhibits nearly all pathogenic bacteria and fungi.

It exerts a prominent action against pseudomonas (Rosenkraz, 1972).

On the other hand, the disadvantages are - 1. Silver sulphadiazine is absorbed to cause crystalluria, 2. Bacterial resistance to sulphonamide can result from the use of this drug, 3. Adverse reactions are burning, rash, itching, 4. It is also very costly drug.

Then came the era of biological dressings. If a functional skin substitute and a reliable skin tissue culture technique becomes available tomorrow; the treatment of burn injuries would change over night. Eschar would be excised in early post-burn period and then covered with skin substitute. Within one or two weeks, the patients would be discharged. After a month, small pieces of autologus healthy skin growth in the tissue culture laboratory would be used to replace this substitute. Within the next two decades, this method of treatment may well become a reality.

Ideal properties of a skin substitute are listed below -

1. It must adhere rapidly and strongly enough with the underlying raw areas.
2. Skin properties should have water vapor transfer characteristic like normal skin.

3. Skin prosthetic should have enough elasticity to stretch freely over joints.
4. Durability enough for the time period required.
5. Intact bacterial barrier,
6. Non-antigenic and non-toxic,
7. Antiseptic.
8. Homeostatic.
9. Ease of application and removal.
10. Minimum expenses.

Materials used for skin substitute are listed below -

1. Biologic

(a) Human allograft (Homograft)

Living donor,
Cadever donar fresh,
Cadever donar frozen,
Amniotic membrane.

(b) Xenograft (Heterograft)

Living donor fresh,
Frozen radiated or dried.

(c) Tissue derivatives

Collagen sheet fabric or sponge,
Bioplast fibrin.

2. Synthetic -

Solid silicon polymer membrane,

Other plastics,

Microporous materials.

3. Composite materials -

Surface membrane (Silicone, Microporous, trydron),

Adherent substrate.

Collagen, cotton gauze, synthetic polymer sponge, vetour, flecking or fabric.

Biological Dressings -

Homografts - About a century ago, Polbeck (1871) applied the first homograft on a burn patient. In 1881, Girdner treated a lightening burn with the skin from a suicide victim. In the same year (1881) Shede used skin from amputation specimen as well as from cadavers with the limit of 24 hours. Ivunova in 1890 stressed the use of foetal skin as homograft on burn surface because of its more energetic vitality.

Jame O'Neill Jr. (1967) used temporary homografts coverage over open wounds including 2nd and 3rd degree burns. Such coverage was of distinct benefit following eschar separation in burn injury. Sharma et al (1978) reported the same results.

Allograft skin besides being satisfactory biological dressings have their own limitations. Cadavers suitable for skin donation are limited in number. Bexter (1970) has estimated 6 physician hours and hospital cost of $ 225 per patient needed to use cadaver homografts.

Amniotic membrane - The amnion is the inner foetal membrane. Its inner surface is in contact of amniotic fluid and foetus. It's outer surface is separated from decidua of uterus by chorion. It has following parts -

1. Placental amnion - lines the inner aspect of placenta.
2. Reflected amnion - lines rest of the chorion.
3. Dependent amnion - overlies the internal os of cervix.

Histologically, it has five layers (a) Epithelium, (b) Basement membrane, (c) Compact layer, (d) Fibroblast layer, and (e) Sponge layer.

Pigeon (1960) observed the following effects in burn cases dressed with amniotic membrane.

(A) Immediate effects -

1. Pain relieved at once after application and no further analgesic were required.
2. Antibiotics were used only after development of complication.
3. The dressing were generally found dry.
4. Healing of wound was rapid and complete.

(B) Delayed Effects -

1. No discolouration was observed in amnion treatment cases.
2. Minimal scar tissue formation.
3. No contracture was observed in amnion treated cases.
4. He also stated that amniotic membrane undergoes changes similar to that in cornified cells.

Xenografts - Because of the limitations in the use of homografts, xenograft came in use. Burleson and Tavis have shown that the adherence of allograft and xenograft is similar. Hetrografts provide a readily available, easily stored and sterilized dressing in contrast to homografts.

In 1960 Canine skin was used by Switzer et al. Porcine skin is the xenograft material of choice, however, Brombray et al & Elliott and Hochn have used pig skin. Variable results have been reported from early re-epithelization. Salisburg (1973) has reported some poor results, when they used this type of dressing on donor sites, with increased inflammation and delayed repair following treatment, comparitive experiments have shown no significant difference in the effectiveness of fresh compound with fresh frozen or frozen irradiation porcine skin.

The most striking advantage with the porcine xenograft in that of immediate and lasting pain relief.

Xenograft has most of the properties of the ideal skin substitute. A viable xenograft is antigenic but the dead is not. The major problem is the propensity to digestion by wound collagenase and subsequent infection.

Collagen sheet - Collagen is a fibrous protein which is present in many animal tissues like skin, muscle and bone. When implanted in living animals tissue, in pure form, it does not produce any antigenic reaction. Collagen sheets are derived from serous and subserous layers of freshly slaughtered cattle intestine. These are available in 4" x 6" size and packed in cylindrical glass tubes containing ethylene oxide which acts as the sterling agent.

Sinha (1972), Shanker (1975) & Gupta et al (1976) used collagen sheets as primary layer material in management of burns. Gupta & Chaturvedi (1974) used it to cover donar areas. Thukral & Gupta (1976) have used collagen material in repair of hernia and to cover surgical defects. Elhans et al (1978) used sheets as biological dressing in 39 patients and reported its role in prevention of infection and in increasing the rate of healing. Jain et al (1976) reported similar findings.

The effect of collagen sheets are -

(a) Prevention of air born infection,

(b) minimisation of fluid loss,

(c) promoting formation of healthy and pink granulation tissue but it is an expensive material and is not available at every centre.

Synthetic material - Pickrell (1942) worked on sulfonamide film. Many of these materials adhere by entrapment of coagulum, in the interestices of the material. Silicon polymer membrane is the best material available because it is elastic, durable and the water vapour transfer characteristics can be controlled by varying thickness. Kornberg et al (1977) have used thin silicon membrane banded to cotton gauze for temporary skin substitution but it lacks elasticity and creates non-uniform pattern of adherence. Other materials are modified polyvinyl chloride or similar plastics which provides more elasticity and water vapour transfer characteristics (James et al, 1975; Lamkey et al, 1977; Fowsend, 1977). The material is thick but the greater disadvantage is the lack of adherence to wound itself. These materials seem to have great promise as temporary skin substitutes for short time applications.

Disadvantages - Inspite of being best dressing material for burn wound, biological dressings, have certain disadvantages in form of -

1. Subgraft suppuration,
2. Limited supply in case of autograft and others,
3. High cost.

4. Lympholized allograft skin shows less adherence to the wound and is of sufficient thickness, undergoes dermal epidermal separation after application to the wound with subsequent desication of the exposed dermis.

5. Potential transmission of disease like hepatitis in case of untaneous allograft.

The problem of burn wound infection is now becoming increasingly important. One could easily determine the location of the burn ward in a hospital by the smell of the pseudomonas infection. The inability of systemic therapy to control local sepsis has seen the introduction of many treatment modalities directed at this problem, e.g. tropical oint. (Fox, C.L. Jr., Rappole, B.W. and Stanford, W., 1969), early surgery i.e. Escharotomy or skin grafting (Burke, J.F., Bondoc, C.C. and Quinby, W.C., 1974) or amniotic membrane application (Bose, B., 1979) whirlpool bath.

Topical therapy has contributed substantially to the reduction of sepsis in the fight against infection. The importance of topical therapy was recognised as early as the last century when simple wound cleaning and cotton wool dressings were used even before the Lister era. But during the span of 150 years, there is still no optimal dressing material which can eradicate the mortality and improve the morbidity figures.

We must therefore consider the qualities required of an ideal topical drug. The desired properties of such a drug can be summarized as follows (Zellner, P.R. and Buggi, S., 1985).

1. It must be non-toxic.
2. It must have antiseptic properties or good microbicidal spectrum.
3. It must pass through and penetrate the eschar.
4. It must not kill viable tissue nor harm the surviving and proliferating tissue.
5. It must not be antigenic.
6. It must have a tanning effect.
7. It must be inexpensive and cheap.
8. It's application must be easy as well as it's removal.
9. It should be durable and readily procurable.

In order to fulfil the above criterion, a number of newer techniques of burn dressings have been evolved. Each has its own advantages and disadvantages.

Out of all these, Povidone Iodine is particularly suitable as a topical agent on burns. However, like so many other topical agents, the ointment lacks the ability to actively penetrate burnt tissue and this distracts considerably from its usefulness in the treatment of burns. Povidone Iodine can easily be applied locally or alongwith Ascarbine (Kock, D.M., 1985). P.V.P. is effective against

a wide range of gram positive and gram negative organisms as well as fungi, but it causes pain on application and excessive drying of eschar (Schwartz, Sheris and Spencer, 1988). Prolonged treatment with Povidone Iodine may effect thyroid gland (Balogh, D., Buer, M. and Riceabona, G., 1985).

On the other hand, Neosporine powder (Wellcome & Burroughs), which can also be used - has the following three ingredients, i.e. Neomycin sulphate, Zinc bacitracin & Polymyxin-B. Neomycin is predominantly a locally acting bacteriocidal having adverse effects as otonephrotoxicity and to a certain extent, depression of respiratory system. Polymyxin-B is antibacterial against mainly M. pertussis, Pseudomonas, E. coli and other gram negative bacilli and has the side effects of acute renal failure and nystagmus. Bacitracin is effective against gram positive cocci and bacilli. The above combination of drugs as Neosporine powder may act as an adjuvant to the action of P.V.P.

Clinical and investigatory tools of assessment of burn wound infection include among others a surface culture and sensitivity report regarding the type of infecting organism and a quantitative estimation of this organism indicating the degree of infection.

Burn wound biopsy provides three parameters for assessment of infection.

1. The first is quantitative bacteriology.

2. The second is qualitative bacteriology.

3. The third parameter of burn wound biopsy is Histology where perilymphatic, perivascular and intra-luminal accumulation of bacteria prove without doubt invasive burn wound infection (Krupp, S., Baechler, M. and Bille, J., 1985).

In the qualitative bacteriology, immediate gram staining shows the presence of bacteria and the identification of bacteria from wound biopsies provides precise identification. The organism which have been recovered from culture of wound swabs and wound biopsies are as follows -

(a) Gram negative bacilli - Enterobacter spp, Klebsella spp, E. coli, Pseudomonas aeruginosa etc.

(b) Gram positive cocci - Enterococci, Staph. epidermidis, Staph. Aureus, and Streptococcus.

(c) Other opportunistic infections - Fungal, e.g. Candida spp, Yeast and viral infection.

The microbial ecology of burn wounds of the patients cared for at any burn unit changes with time and alteration in the flora occur as a series of minor epidemics with a succession of predominant organisms.

In view of the above organisms found locally, a topical antimicrobial with a total spectrum coverage and minimal side effects and at the same time easy to apply with minimal strain on nursing personnel is desirable. P.V.P. with Neosporine may fill this gap which has been unfilled to date.

The nearest to this appears to be SSD but it too has some side effects especially tedious nursing work.

This study would examine the efficacy of P.V.P. and Neosporine in the above light especially in comparison to SSD and amniotic membrane application.

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MATERIAL AND METHODS

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The present study has been conducted at M.L.B. Medical College, Jhansi, from June 1989 to June 1990. Two groups of patients with superficial burns and deep burns were included in the study, which were sub-divided into three sub-groups matched by age and percentage of burn. One sub-group was treated with a combination of Povidone Iodine lotion + Neosporin powder (PVP + N) and the other two by Amniotic membrane and Silver sulfadiazine (SSD).

Neosporin Powder (Wellcome & Burrough) - It is available in powder form, 10 gm pack, are available in the market. This powder contains the following three ingredients.

1. Polymyxin B sulphate - Each gram of Neosporin powder contains 5000 U.B.P. of Polymyxin B sulphate.

2. Zinc Bacitracin - Each gm. of Neosporin powder contains 400 U.B.P. of Zinc Bacitracin.

3. Neomycin sulphate - Each gram of Neosporin powder contains 3400 U.B.P. of Neomycin sulphate salt.

Neosporin powder is sprinkled over burn area till a uniform coating of powder is obtained.

Betadine Lotion :- is available in 10% Povidone-Iodine form providing 1% available Iodine.

Silver Sulphadiazine Ointment - This is available as 1% ointment in ready-made jars of 500 gm and tubes of different quantities. This ointment was applied by uniform layering of burn area and then covering of burn area by sterile dressings.

Method of study -

The selected cases were subjected to detailed history and physical examination which were recorded on following lines -

History Introduction - Name, age, sex, occupation, rural/urban, address, date of admission, date of discharge and time of healing.

Regarding the burn accident -

- Date and time of burn (duration of burn),
- Place of accident and nature of work at the time of accident,
- Cause of burn,
- Prior treatment (if any),
- Symptoms.

Physical Examination :

General Examination - The case was examined for general condition, pulse, B.P., temperature, respiration, hydration.

Local Examination -

(a) Percentage of Burn - It was calculated by 'Wallace's rule of nine', In the adult, and by Lund & Brown chart in children.

(b) Depth of Burn - Superficial / Deep.

Estimation of depth of burn -

The hypodermic needle was used to test the pain sensation. The area with increased sensibility was considered to be superficial or partial thickness burn. The area with markedly reduced or absent pain sensibility was considered to be deep or full thickness burn. This was also confirmed by pulling out a hair from burn surface. In the 3rd degree or deep burn, hair pulls out easily and painlessly. The latter test is of value in borderline cases of second degree burn. In addition, help of the following criteria was also sought.

Classification of depth	Appearance of Burn area	Pain sensation
I degree	Erythematous	Painful and hyperaesthetic.
II degree :		
(A)	Blisters with reddened base and moisture.	Painful and hyperaesthetic.
(B)	Blisters with blanched base and moisture.	Painful hyperaesthetic or anaesthetic at places.
III degree	Leathery pale or pearly white or charred dry.	Painless and anaesthetic.

The I & II(A) were included as superficial and II(B) & III were considered as deep burn.

(c) Contamination of wound :

Apparently clean - No contamination of foreign body, clean intact blisters.

Mild contamination - Slight contamination, ruptured blisters, open wound,

Gross contamination - Heavy contamination with dirty cloth, foreign body, dust and/or non-medical substances i.e. cow-dung, mud etc.

(d) Area involved - Diagramatic representation in anterior posterior and lateral view (shown in attached proforma) was done.

Resuscitation and General Management :-

The patients were resuscitated prior to application of Betadine with Neosporin powder or Silver sulphadiazine ointment by I/V fluid, blood, analgesic antibiotic and tetanus prophylaxis, according to the need of patients.

Local Management of wound :-

Preparation of burn surface - A swab from burn surface was taken for culture sensitivity test. Patient was given necessary sedation. A gentle but thorough debridement of wound was done by removing necrosed skin and blisters. The area was again tested for degree of burn. Then the

wound was cleaned with 0.5% Savlon solution twice followed by sterile normal saline thoroughly.

Application of PVP + Neosporin powder in superficial burn :

The application was started by cleaning with saline or Savlon then sprinkling a uniform layer of Neosporin powder on burn surface. Over this the solution of PVP with 1% available Iodine was sprayed uniformly, thus completely soaking the powder. A further layer of powder was applied to form a crust. On the first day, three such applications were carried out without removing the previously applied layers. On the second day, the application was reduced to two and from the third day onwards, this application was limited to those areas from which the crust was either separated or cracked. Subsequently, those areas showing discharge with infection were subjected to twice daily applications each time after removal.

Method of sub-Escharal Injections (Escharolysis) of Betadine Lotion in deep burn patients :

In patients with deep burns, the PVP solution (1% available iodine) was diluted with three equal volumes of normal saline and was injected at multiple sites in the subescharal plain as a 0.25% solution. Each injection prick received 0.5 ml of this solution. This injection was started on the third post-burn day and repeated twice weekly until escharolysis was completed. The injections

amounts to about 0.5 ml per square inch of burn surface every time. In patients with more than 50% deep burns, injection was restricted to three injections at 72 hours. 7th day and 14th day, basically to limit the amount of PVP injected. SSD was applied as for superficial burns.

S.S.D. Application -

Dressing soaked in 1% S.S.D. ointment were applied over burn area by the closed method and covered by gauze piece and cotton of sufficient thickness to absorb all exudation without penetration to the surface. Dressing was changed daily.

Application of Amniotic membrane -

Fresh or preserved amniotic membrane were taken. The membrane with bad odour and colour changes were discarded. It was stretched open and then applied over burn area about one inch beyond the margins. The temperature of membrane was not considered. The air bubbles between membrane and wound area were removed. The patients were instructed not to move the pack until the membrane became adherent and relatively dry. It was left as such without any dressing except in children and un-cooperative patients where the dressing was applied to retain the membrane.

Assessment of the case -

The assessment of the result was done by interview with the patients, examination visits and investigations.

Interviews - The patient was asked about -

1. Pain and discomfort (mild, moderate or severe),
2. Fever,
3. Any evidence of allergy as "Itching, rashes, nausea & vomiting.

Local Examination -

Observation for the following was done -

1. Presence of discharge and/or soakage,
2. Appearance of burn area covered by Betadine, Neosporin powder, SSD and Amniotic membrane,
3. Collection of pus under dressing. If the pus was localized, it was cleaned and thoroughly washed. Fresh application of dressing was done. A pus swab was taken for culture and sensitivity test.
4. Formation of crust,
5. Formation of healthy granulation tissue,
6. Appearence and duration of eschar,
7. Assessment of epithelization and healing of wound.

WORKING PROFORMA

Name :

Age :

Sex :

Address :

Date of burn :

Date of primary treatment :

Date & time of admission (Interval between burn and admission) :

Percentage of burn -

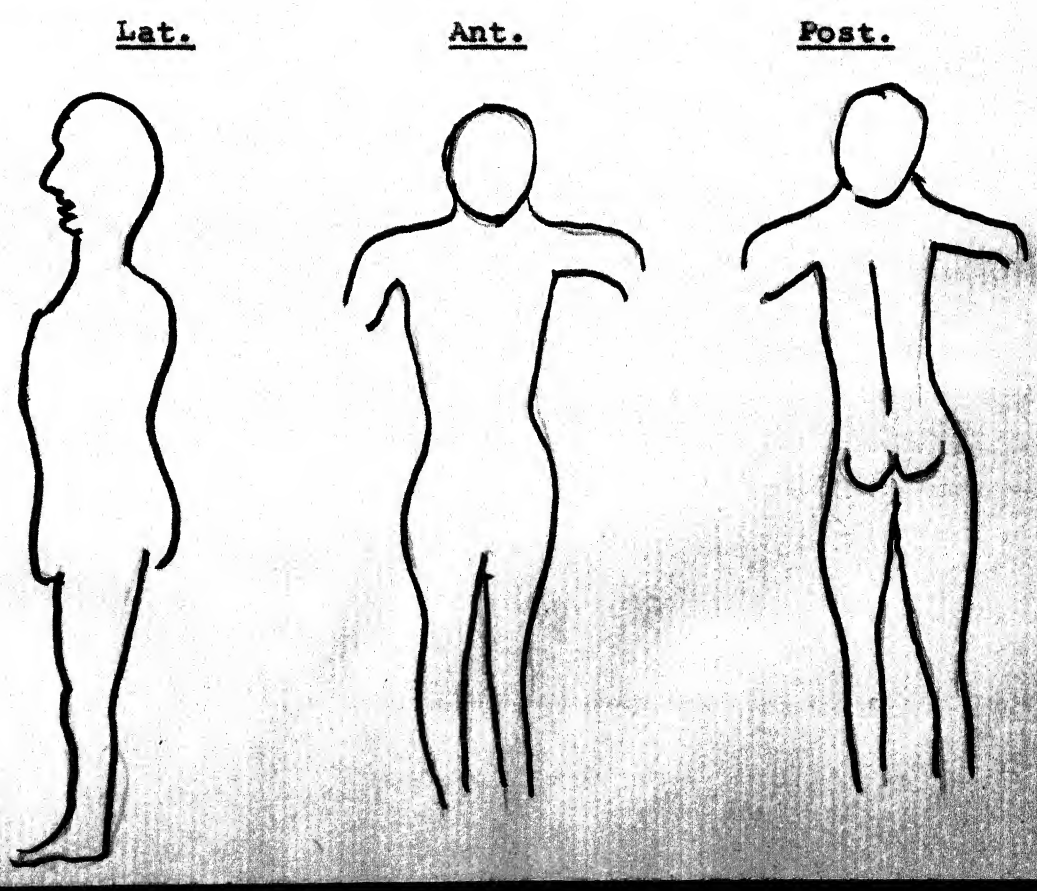
Superficial :

Deep :

Nature of burn :

Method of sustaining :

Primary treatment given prior to admission :



Clinical Examination -

- Pulse rate (P.R.) :
- Blood Pressure (B.P.) :
- Respiratory rate :
- Temperature :
- Urine output since burn :
- Infection :
- Eschar :
- Type of burn -

  Superficial :

  Deep (Eschar) :

Treatment given

Fluids :

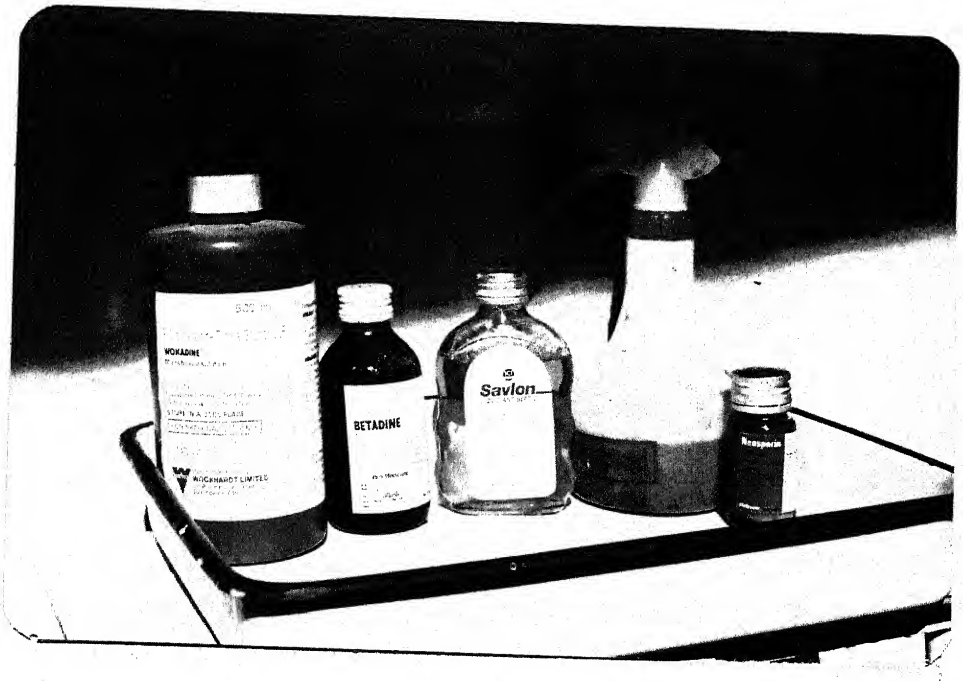
Antibiotics systemic :

Ryles tube aspiration(RTA) :

Catheterization :

Topical microbicidal

	I		II	III
	Povidone iodine + PVP Neosporin			
	Superficial (PVP+N)	Subescharal (PVP)	Silver Sulphadizine (SSD)	Amniotic membrane
No.of applications				
Ist day				
2nd day				
after 48 hours				
Evaluation				
Urine output/24 hrs.				
Infection -				
- Local				
- Toxaemia/ Septicaemia				
Eschar separation :				
- Started (days)				
- Completion (Separation)				
Surface culture and sensitivity report				
Qualitative				
- Pre-treatment				
- 48 hours				
- 7 days				
- After eschar separation				
Quantitative				
- 48 hours				
- 7 days				
Time of complete healing (days)				
- With grafting				
- Without grafting				
Mortality				



Photograph - A

Showing materials as Betadine lotion, Savlon, Lotion spray machine and Neosporin powder in a tray.

Photograph - B

Showing materials for subescharal injections of diluted Betadine with syringe (20 ml.) & Needle (No. 18, 1½ inch length).

OBSERVATIONS

OBSERVATIONS

The present study comprises of 75 patients of superficial and deep burns admitted in surgical and Emergency wards of M.L.B. Medical College, Jhansi, from June 1989 to June 1990. Both groups of patients namely 47 patients of superficial burns and 28 patients with deep burns were divided into three sub-groups matched by age and percentage of burn.

One group comprising of 50 patients was treated with combination of Povidone Iodine lotion + Neosporin powder (PVP + N).

Second sub-group comprising of 18 patients was treated with Silver Sulfadiazine (SSD).

Third group comprising of 7 patients was treated with Amniotic membrane (A.M.).

Most of the burn cases were in their early age groups (Table I). 38 patients out of 75 were below the age of 30 years. This clearly indicates that burn incidence was more in third decade of life (Table I).

Maximum incidence of burn was in middle aged group females. 36 female patients out of 53 were in the

15-45 (47.9%) years age group. In male of similar age group, incidence was only 18.6%. The higher incidence in females could be because of involvement with cooking or as suicidal burns. Peak incidence of burn in males was in 16-30 years of age group (Table II).

Out of 75 patients, 58 patients (77.2%) reached hospital within 24 hours of injury and 12 patients (16.0%) reached upto 48 hours. It indicates that patients with burn involving larger area seeked early medical attention (Table III).

Superficial burns were more common (62.6%) involving patients upto 30 years (Table IV).

Treatment regimes of burn patients i.e. open dressings including Povidone Iodine + Neosporin was applied on 50 patients and Silver Sulfadiazine was applied on 18 patients. Amniotic membrane as closed method was applied only on 7 superficial burn patients (Table V).

Both groups of patients (superficial & deep) showed a lesser incidence of growth of organisms both at 7th day and 18th day were treated with PVP + N as compared to SSD and Amniotic membrane (Table VI).

Quantitatively the percentage of patient presenting a bacterial count below $10^5/CM^2$ was markedly better in PVP + N treated patients both with superficial

and deep burns as opposed to SSD (Table VII). 7th & 18th days were selected because this is the time when septicaemia is most likely to occur.

As for rate of healing most of the superficial burn patients when treated with PVP + N showed complete healing within 30 days with the majority recovering within 15 days while in the SSD group although the majority healed within 30 days a substantial number of wounds took 45 days to heal. Deep burn patients treated with PVP + N healed after 45 days. Four patients with 50% burns expired. In the SSD group, healing was delayed upto a maximum period of 60 days and out of the 4, one patient died on 4th day because of fluid and electrolyte imbalance and three patients expired at the third week because of septicaemia (Table VIII).

In amniotic membrane treated cases, wound surfaces in 6 out of the seven healed completely within 30 days and in one case healing was delayed due to pus collection under membrane and which healed after 45 days.

Healing was better and speedy when Povidone Iodine lotion with Neosporin powder was applied over burn area.

The result clearly shows that Povidone Iodine lotion with Neosporin powder application was better against the SSD ointment and amniotic membrane in both superficial and deep burns.

Table I

Age incidence

Sl. No.	Age group in years	No.of cases	Percentage of burn
1.	0 - 15	10	13.3%
2.	16 - 30	28	37.3%
3.	31 - 45	22	29.3%
4.	46 - 60	15	20.0%
5.	> 60	-	-

Table II

Showing sex distribution in different age groups.

Sl. No.	Age group in years	Male		Female		Total	
		No.	%	No.	%	No.	%
1.	0 - 15	4	5.3	6	8.0	10	13.3
2.	16 - 30	8	10.6	20	26.6	28	37.3
3.	31 - 45	6	8.0	16	21.3	22	29.3
4.	46 - 60	4	5.3	11	14.6	15	20.0
5.	> 60	-	-	-	-	-	-

Table III

Showing time interval between burn accidents and hospital arrival.

Sl. No.	Duration in hours	No. of cases	Percentage
1.	0 - 12	38	50.6
2.	13 - 24	20	26.6
3.	25 - 48	12	16.0
4.	49 - 72	3	4.0
5.	> 72	2	2.6

Table IV

Showing percentage and depth of burn.

Sl. No.	Percentage of burn	Superficial	Deep	Total
1.	0 - 15	12	5	17
2.	15 - 30	13	11	24
3.	30 - 50	18	9	27
4.	> 50	4	3	7
Total		47(62.66%)	28(37.33%)	75

Table V

Showing treatment regimes.

Sl. No.	Percentage of burn	PVP + N		SSD		Amniotic Membrane
		Superficial	Deep	Superficial	Deep	Superficial
1.	0 - 15	5	3	3	2	4
2.	15 - 30	9	7	2	4	2
3.	30 - 50	13	8	4	1	1
4.	> 50	3	2	1	1	0
Total		30	20	10	8	7

Table VI

Surface culture reports.

Organism	PVP + N						SSD						A.M.		
	Superficial			Deep			Superficial			Deep			Superficial		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Staphylococcus	15	8	6	12	6	2	8	7	5	7	6	2	4	1	1
Streptococcus	12	6	3	10	5	1	6	3	3	7	4	3	1	1	1
E. coli	8	3	1	5	-	-	3	2	2	4	2	1	-	-	-
Klebsiella	2	1	-	1	-	-	2	-	1	-	1	-	-	-	-
Proteus	6	2	1	4	1	-	8	4	2	6	4	4	-	-	-
Pseudomonas	6	1	1	1	-	1	2	1	1	2	3	4	-	1	-

1 = At the time of admission

2 = 7th day post burn

3 = 18th day post burn.

Table VII

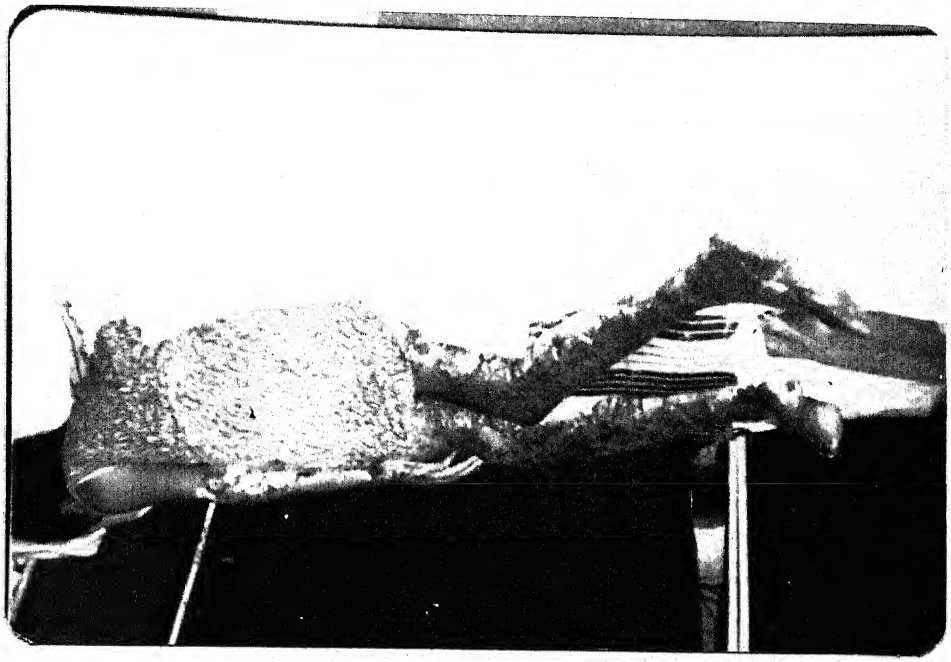
Bacterial count after treatment.

Bacterial count	Treatment			
	PVP + N		SSD	
	7th day	18th day	7th day	18th day
Sterile	28 (56.0%)	32(64.0%)	8(44.4%)	7(38.8%)
$< 10^5/CM^2$	20 (40.0%)	16(32.0%)	7(38.8%)	9(50.0%)
$> 10^5/CM^2$	2 (4.0%)	2(4.0%)	3(16.6%)	2(11.1%)

Table VIII

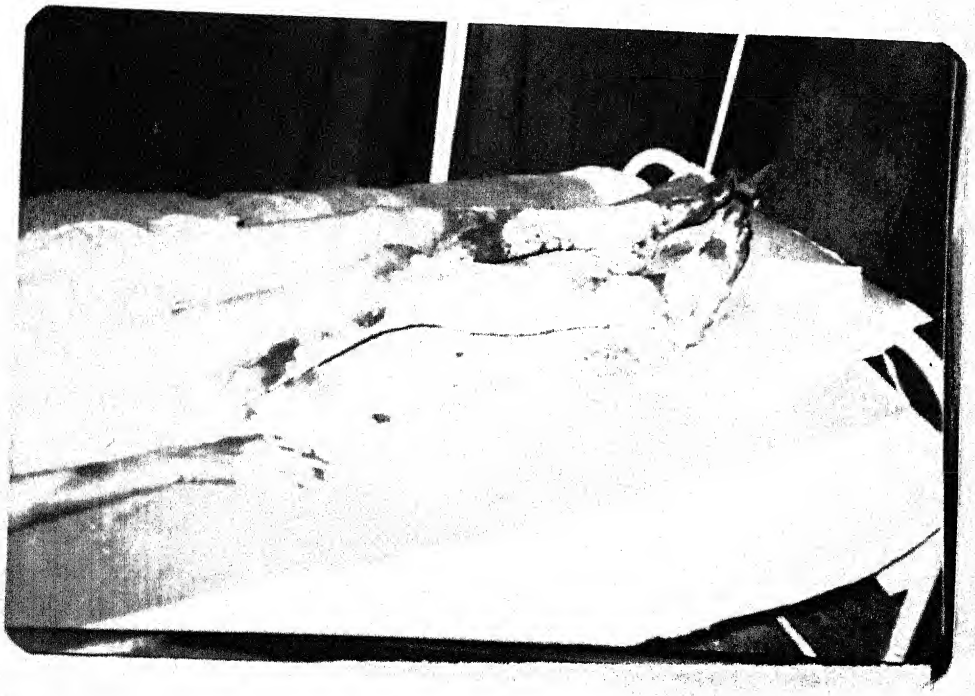
Rate of healing

Healing Time (days)	PVP + N					SSD					A.M.				
	Percentage of burn					Percentage of burn					Percentage of burn				
	0-15	15-30	30-50	7 50	Total	0-15	15-30	30-50	7 50	Total	0-15	15-30	30-50	7 50	Total
Superficial Burn															
0 - 15	4	8	3	-	15	2	1	1	-	4	1	1	-	-	2
16 - 30	-	2	7	4	13	1	1	1	-	3	2	2	-	-	4
31 - 45	-	-	-	2	2	-	-	-	2	2	-	-	1	-	1
45 - 60	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-
7 60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deep Burn															
0 - 15	1	1	-	-	2	2	0	0	0	2					
16 - 30	5	2	-	-	7	1	-	-	-	1					
31 - 45	-	-	4	2	6	1	1	-	-	2					
45 - 60	-	-	-	1	1	-	-	-	-	-					
7 60	-	-	-	2	2	-	-	-	1	1					



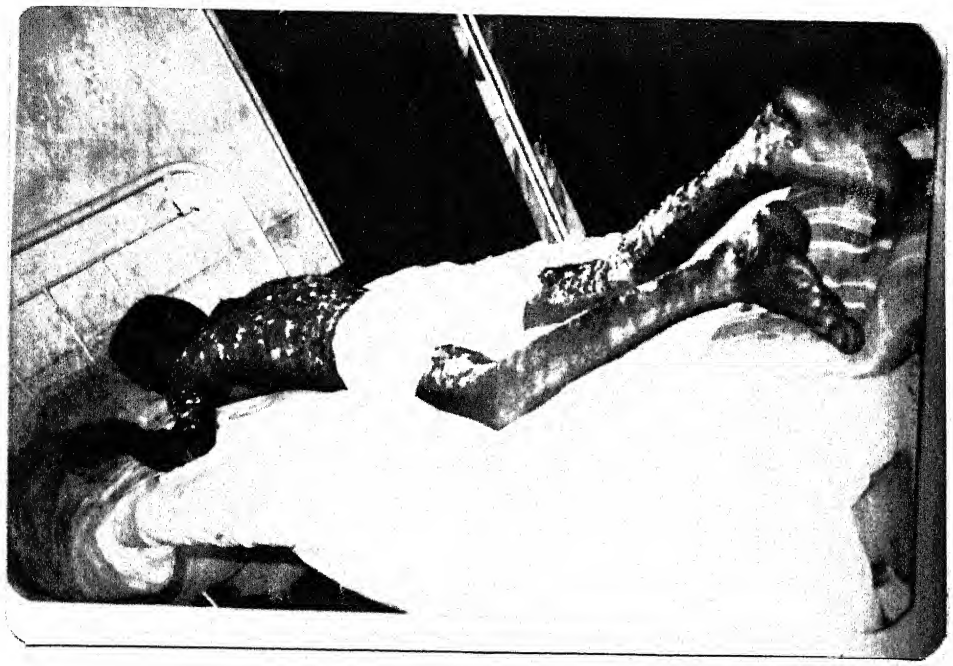
Photograph - 1

Showing 24% burn wound healing after application of Betadine lotion and Neosporin Powder dressing on 15th day.



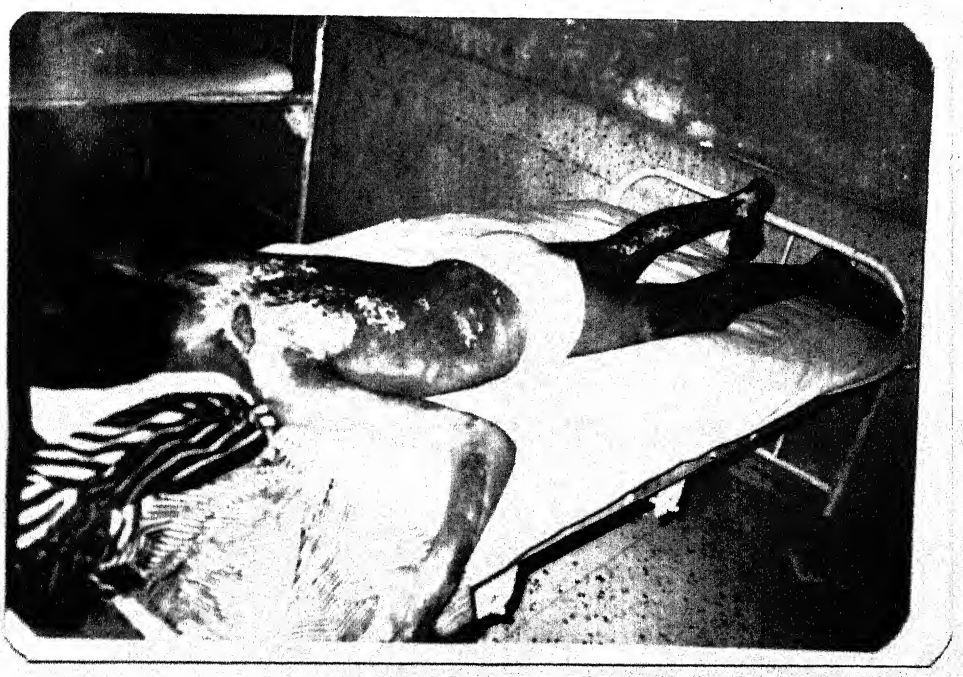
Photograph - 2

Showing 15% burn wound healing after application of PVP + N dressing on 12th day.



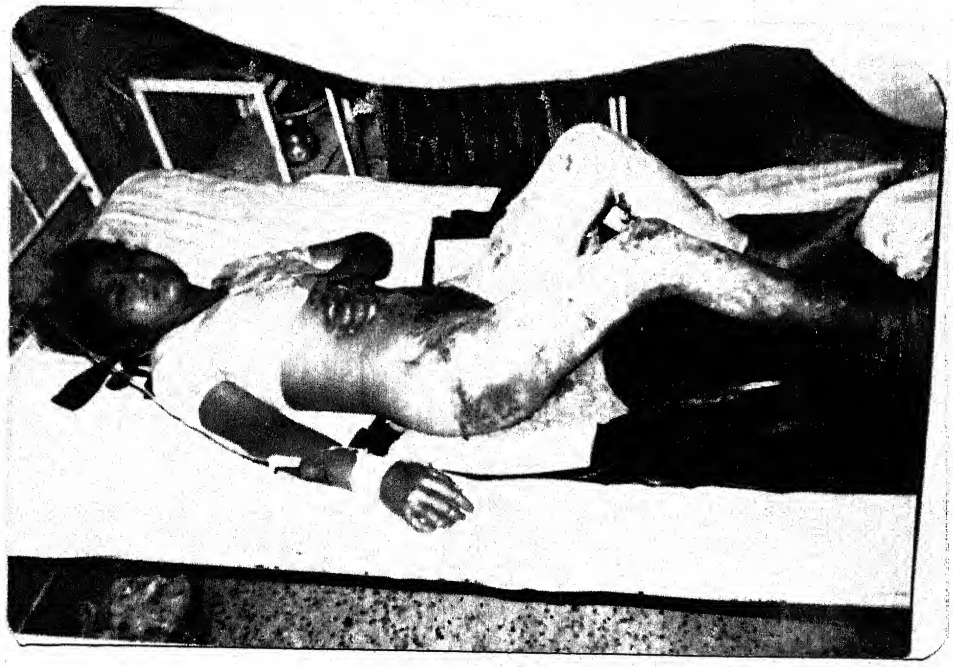
Photograph - 3

Showing healing after 18 days of application of Betadine and Neosporin powder.



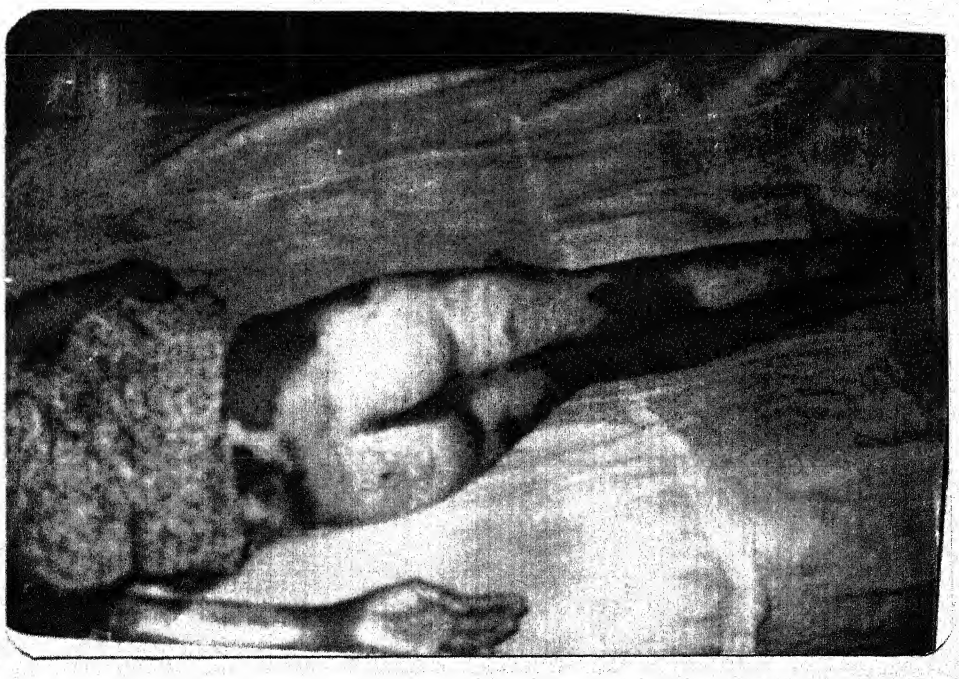
Photograph - 4

Same patient as in Photograph 3 showing complete healing on 30th day.



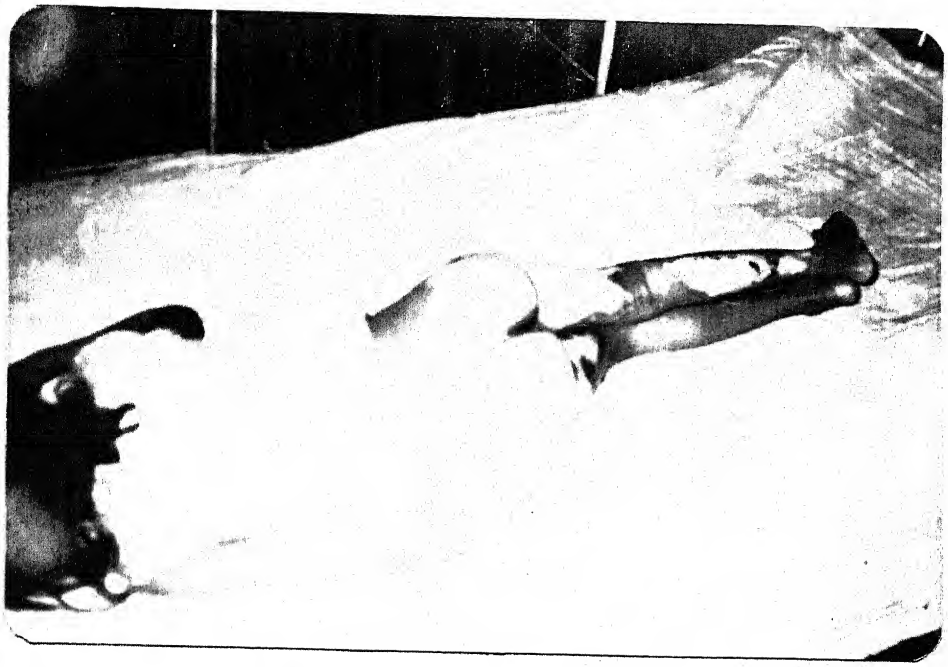
Photograph - 5

Showing burn wound just before application of Silver Sulfadiazine ointment (SSD).



Photograph - 6

Showing same patient (photograph 5) with Silver Sulfadiazine dressing on 28th day.



Photograph - 7

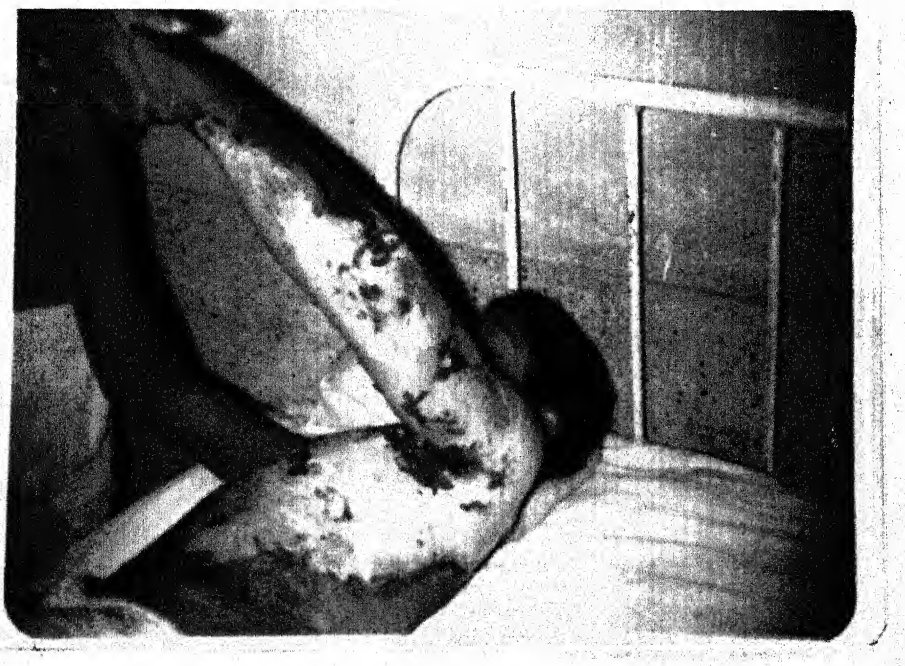
Showing burn wound healing after application of Silver Sulfadiazine dressing on 30th day.

Photograph - 8

Same patient (photograph 6) showing complete healing on 35th day dressing with SSD.

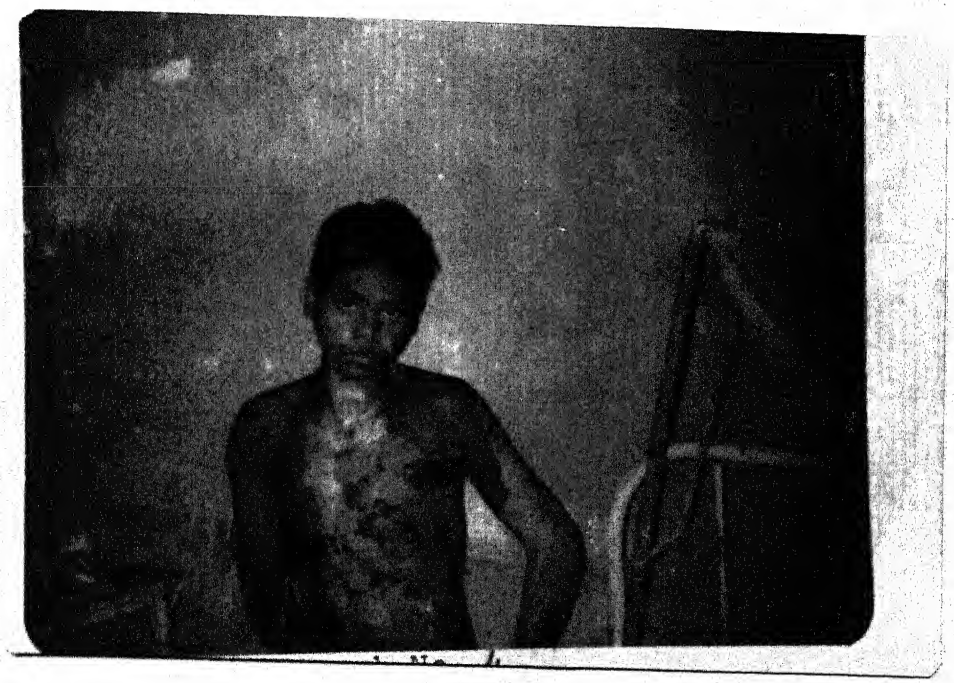
Photograph - 9

Showing burn wound just before application of Amniotic membrane.



Photograph - 10

Showing burn wound just after the application of Amniotic membrane.



Photograph - 11

Same patient as in photograph 10 showing process of separation of membrane and healed area on 18th day after application of membrane.

DISCUSSION

DISCUSSION

Burns are notorious in the sense that they break the continuity of skin and produce great raw areas. Burns are the ischaemic wounds, where confluent thrombosis which involves arterioles, capillaries, venules and at times even larger vessels is characteristically present especially in full thickness. In partial thickness burns thrombosis is incomplete, the dermal circulation is deeper, viable segment of the dermis is gradually re-established within a few days, although the dead superficial portion of the dermis of course remains avascular.

Because of wound ischaemia, systemically administered antimicrobial agents are not reliably delivered to the site where they are needed by the vascular routes, as diffusion from the wound peripherally, for a variable but often considerable distance is their only means of access, moreover the wound surface close to the heat source is at once the most severely injured and ischaemic and as well as the original site of most burn wound infections. Topical agents are therefore best used to treat burns.

Normal skin harbours few pathogenic bacteria. Most burns are sterile initially, although contamination

usually by soil or water or dirty linen may occur after accident. Because of the greater raw area burn wounds are more prone for invasion by micro-organisms. In large burn areas, dense colonization of pathogens can occur within 24 hours. In untreated patients, immediately after injury few bacteria can be recovered and these are predominantly gram positive. The type and density of organisms present in the untreated burn wound change with time, so that by the fifth post burn day, pseudomonas can be recovered. By the middle of second post burn week the burn wound organisms are predominantly gram negative, the organisms penetrate the eschar by migration and extend down to viable - non-viable tissue interface. At this site further microbial proliferation commonly occurs and promotes lysis of denatured collagen and spontaneous slough of eschar. In patients with inadequate host defence capacity or those in whom the topical therapy is ineffective, the sub-eschar organisms invade the underlying non-burn tissue and may spread systemically. Adequate topical therapy should therefore be instituted as rapidly as possible following injury. Topical wound therapy in patients with large burn is equally as urgent a need as is fluid resuscitation.

The water retaining ability of the skin depends on its effective vapour pressure and the diffusion barrier offered by Keratin layer and lipid contents in the stratum

corneum. This lipid is thermo-liable and this barrier is removed after thermal injury, the effective vapour pressure gradient is increased by 15-20 times. This results in a large amount of evaporative water loss amounting to an increase to 3-10 times the normal rate of insensible water loss i.e. 40 ml/hour. The amount and duration for which the loss persists depends on the depth and percentage of burn.

Therefore, among the main aims in the treatment of burn is to re-establish the continuity of skin. In superficial burns healing may occur spontaneously but the danger of conversion of superficial burn to deep burn by infection and/or dessication and loss of body constituents remains a major problem and therefore coverage of raw area becomes necessary. Topical burn therapy most likely began after man's first adverse encounter with fire. Initially there was no knowledge of the existence of bacteria or of the immune response, or of the ischaemic nature of wounds and topical medicaments were intermittently applied to burn areas to relieve pain and to enhance the healing. The widely empiric remedies of prelisterian era were of course excusable because they were conceived in ignorance. Fortunately, enough knowledge now is exists to permit a rational evaluation of agents currently available or newly proposed in the treatment of burns.

The concept of temporary biological dressings was introduced in 1930 by Brown. Homografts and heterografts split thickness skin have both adequately served the functions required of a biological dressing. In 1953, Brown et al reported that it was practical to use post-mortem homografts as biological dressings. Since then, cadavers have provided the usual source for homografts. Heterografts have not proved as effective as homografts in decreasing bacterial contamination of the wounds.

Amniotic membranes were chosen for evaluation. It is not necessary to point out how easy and impersonal it is to obtain this widely distributed human material which at present seems to find its only destiny to be "thrown into the bucket", especially if it is normal. It has been stated that since amniotic membrane is formed by the ectoderm of the foetus, it is like an extension of the body skin.

Amnion, chorion and the combined foetal membrane have been used by various investigators as a substitute for skin in the past. Since Sabella's first case describing the use of amniotic membrane in the burn wound 50 years ago, multiple reports have appeared in the world's literature. Most of these were reporting the attempts to use amniotic membrane as a permanent substitute for skin autografts or as a dressing over partial thickness burns.

Dahinteroa and Dobikovsky observed failure when amniotic membranes were applied in deep burns or on severely infected areas. They pointed out that the membranes became autolyzed in 48 hours and disintegrated. Furthermore, they stated that the same was true on all granulating surfaces even if they were clean. Similar findings have been reported by others. In these cases, the membranes were changed every 48 hours. As demonstrated by Shuck & Mancrief (1958) for homograft skin in a less tidy wound, more frequent changes prevent collection of purulent material under the biological dressings. This allows firm adherence of the membrane to the underlying granulation.

Frequently changed amniotic membrane were more successful in decreasing the bacterial count in contaminated rat burns than human skin. This raised the question as to whether there was a substance in amniotic membrane which was specifically antibacterial. One such possibility is allantoin which is known to exist in amniotic membrane. Another possibility is lysozymes, a bacteriolytic protein of low molecular weight which is present in amniotic tissue. Rubin & Bargiovi recently stated that skin itself possesses bactericidal substances in its biological make-up such as lysozymes and certain fatty acids. Neither, however, could demonstrate bacterial inhibitory activity of split thickness human skin in vitro when measured by a disc sensitivity technique.

Another hypothesis for the observed decrease in the bacterial count under the amniotic membrane lies in the intimate biologic closure of the open wound by membrane restoration and the functional circulation through the covered granulations allows a more rapid turn over of phagocytes, serum bacteriolytic factors and may actually accelerate the removal of necrotic debris. Therefore, repeated applications of the membranes allow the host resistance factor in the granulating bed to function at peak efficiency. The increased antibacterial effects seen with the amniotic membrane may be due to the fact that it is less well differentiated than skin.

The amniotic membrane fulfilled all the functions of an ideal biological dressing. In terms of their larger size and ready availability at no cost to the patient, they are actually superior to homograft and heterograft skin. Chao et al and Troensegaard possess some specific healing power. They have reported a stimulation of fibrous tissue growth and more rapid epithelial repair. In the present study, it has been noted that pain and discomfort disappears immediately after application of amniotic membrane and no further analgesics or sedatives were required after the dressing. Occasionally sedative was required for psychological support. No allergic symptoms like rigor, rash, vomiting and giddiness were noticed even after close watch. These findings are comparable

with the published reports of other workers. Cause of disappearance of pain and discomfort is coverage of exposed nerve endings.

It has been observed that amniotic membrane adhered and became dry in 6 - 8 hours in hot and dry atmosphere and in 12-24 hours in cold and wet atmosphere. Adherence has been proposed to be most important property of biological and synthetic materials applied to de-epithelized surfaces. It reduces pain, bacterial contamination and consequently optimize the rate of healing. Most prosthetic grafts rely on the endogenous adhesive fibrin for adherence. This property of material is therefore determined by the strength of bone that it forms with fibrin. Studies have demonstrated that fibrin binds preferable to collagen in normal skin.

In most of superficial burn cases with mild contamination, where membrane was applied after proper cleaning. No soakage was seen. Cases needed only one application and healed quickly.

A wide number of antimicrobials have been used from time to time, but almost all of them have been abandoned in favour of Silver Sulfadiazine which has a wide spectrum of action against organisms including Staph aureus, E. coli, Proteus, Pseudomonas, Entero-bacteria and Candida albicans and at the same time has

minimal side effects. Thus, it was logical to choose this as the parameter to judge the effectiveness of the combination of PVP + N.

Local polymyxin + Neomycin + Bacitracin (Neosporin) and Povidone Iodine (PVP) combination form an almost complete barrier against colonization by pseudomonas pyocyaneus but not so against staphylococcus aureus and haemolytic streptococci. Povidone Iodine on the other hand has a wide antibacterial antifungal sporicidal and viricidal properties. Neomycin and Bacitracin supplement this action especially in relation to gram negative organisms.

Literature recommendations cite a bacterial count of $10^5/CM^2$ of tissue as the upper limit below which deeper penetration is minimal. Our study using PVP + N showed an appreciably better percentage of sterile cultures as compared with SSD both at 7 days (56.0%) and 18 days (64.0%) of post burn. Similarly, the numbers of cultures below $10^5/CM^2$ were significantly less for PVP + N at 18 days. Even patients with a count of more than $10^5/CM^2$ were less in the group treated with PVP + N. These figures agree with other studies. Thus, Moncrief (1958) has shown 40% sterile cultures and 84% less than the critical level of $10^5/CM^2$ in a study of more than 3200 bacterial cultures which compare well with our

corresponding values of 64.0% and 96.0% on day 18 using PVP + N. Zellner & Bugyi (1985) too have shown better results with PVP as compared to SSD. Our results which are markedly better than other studies with only PVP are due to the addition of Neosporin.

The rate of healing also showed a marked improvement of SSD in both superficial and deep burn categories. The tanning effect of PVP is an added advantage for this keeps the surface dry so holding colonization to a low level and also permitting early surgery. PVP + N combined forms a "crust" which sets up a barrier to colonization and at the same time keeps the surface dry. In patients with superficial burns when epithelization was complete, the crust separated itself and in clean cases no single incidence of infection was found.

In deep burn wounds, multiple injections of PVP subescharally helped in two ways. In the first phase, it kept the subescharal bacteria count to a low level. In fact this bacterial colonization and its inaccessibility to topical antimicrobials have been major factors in burn wound sepsis of deep burns. That subescharal injection of PVP was beneficial was evident from the results, namely no single septicaemic mortality occurred in deep burn patients. The second beneficial effect is that it

opens up a subescharal plane thus helping in early escharolysis and decreased bleeding on separation. The burn wound in most of these patients could be grafted immediately after the eschar separation which was in marked contrast to the fact that topical agents are totally ineffective in subescharal colonization including superficially applied PVP cream and also that after escharectomy or lysis a considerable period of time is spent in limiting the infection at the burn site, before grafting can be taken up. Subescharal PVP injections were attempted basically because PVP has been shown to have beneficial antibacterial effects when used subcutaneously, intra-peritoneally or intra-pleurally without any serious Iodine toxicity. The concentration of 0.25% PVP may seem to be too low for it to be effective but it has been mentioned that with this concentration there is an increase in free Iodine and antibacterial activity. None of our patients showed any clinical evidence of Iodine toxicity. The PVP injections in deep burns of more than 50% were limited to three in order to limit the total amount of PVP injected. We found that subescharal injections markedly reduce the incidence of septicaemia and mortality in these patients and at the same time keep the surface healthy. Application of PVP + N was accompanied by minor pain, but what was most important was that pain accompanying repeated dressing of SSD or

other topical agents was not seen basically because this was an open method and did not require removal of previously applied layer. This in our view is an important psychological and clinical advantage and at the same time saves a lot of nursing personnel time. The Iodine levels are elevated after PVP application but this level creates no significant impairement of thyroid functions or manifestations of Iodine toxicity. Further Iodine levels return to normal within a week after applications are stopped. Similarly, the repeated serum creatinine compared with those of patients being treated with SSD showed that no toxicity because of the drug contained in Neosporin mainly bacitracin and Neomycin which are really toxic. This was probably because after the three and two applications on day one and two, subsequent applications were limited to only those areas which were denuded, thus largely limiting the total amount of drugs used to a bare minimum. Even the PVP solution used compared favourably with PVP ointment commonly used in terms of the lesser amount of PVP used.

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CONCLUSIONS

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The comparative effects of PVP + N, SSD and amniotic membrane application were studied and compared in 75 burn patients. Out of which 47 patients were of superficial burn and 28 patients were of deep burn. Conclusions drawn are as follows -

1. Females are more affected in the age group of 15-35 years.

2. Most burn accidents involving, females were either suicidal or homicidal. Majority of these burns were thermal in nature and occurred in rural area.

3. Patients with major burn came directly to medical college hospitals much earlier than those with minor burns who reached the surgical OPD only when the burn became grossly contaminated.

4. Superficial and deep burn involving smaller areas healed without scar.

5. No allergic reaction was observed in application of Povidone Iodine with Neosporin powder application while allergic reaction was noticed in one patient when Silver Sulfadiazine was applied.

6. Contractures were observed in 6 cases when Povidone Iodine with Neosporin powder was applied and 3 cases when Silver Sulfadiazine ointment was applied.

7. The scars were whitish flat in SSD ointment treated cases and yellowish tinged hyperpigmented and more fibrous in Povidone Iodine with Neosporin powder application and scars of completely healed areas were hypopigmented in amniotic membrane application.

On comparing the effect of two dressings to assess the superiority of either of them, following conclusions were drawn :

1. Only amniotic membrane requires storage in sterile container with saline dilution of 1 : 40 at $4^{o}C$ with addition of 1 gm of Kenamycin sulphate or 10 Lakhs units of crystalline penecilline or 1 gm streptomycin sulphate etc., while Silver Sulfadiazine ointment and Povidone Iodine with Neosporine powder requires no specific storage facility.

2. Daily changing of dressing with SSD causes pain to the patient while PVP + N used in superficial and deep burns caused minimal pain since daily dressings were not required hence, irritation of exposed nerve endings was avoided as in closed dressings. Application of amniotic membrane also causes no pain to the patient except during cleaning.

3. The healing is faster in Povidone Iodine with Neosporin powder treated cases than was with Silver Sulfadiazine ointment and amniotic membrane.

4. Silver Sulfadiazine and amniotic membrane gave good results with superficial and smaller areas of burn. On the other hand, Povidone Iodine & Neosporin gave good results in all types of superficial, deep and neglected cases of burn. Povidone lotion injection diluted in saline injected in the subescharal plane gave very good result in controlling infection and early escharolysis followed by early graft take up and subsequent healing and also reduces the chance of septicaemia.

In brief, the conclusion may be drawn that treating superficial and deep burn patients by using Povidone Iodine lotion + Neosporin powder (N) is markedly superior to other known methods as shown by the minimal infection rate and markedly reduced healing time. This is basically because of wide spectrum of action, tanning effect of PVP and attainment of a dry burn surface.

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